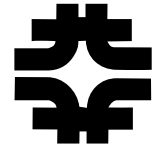


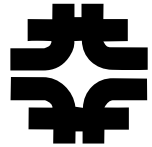
Overview of Accelerator Operations

Steve Holmes

Fermilab

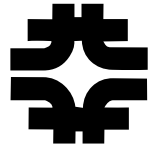
March 29, 2004

Outline



- Accelerator Program Mission and Goals
- Strategy and Resources
- Challenges and Risks
- Summary

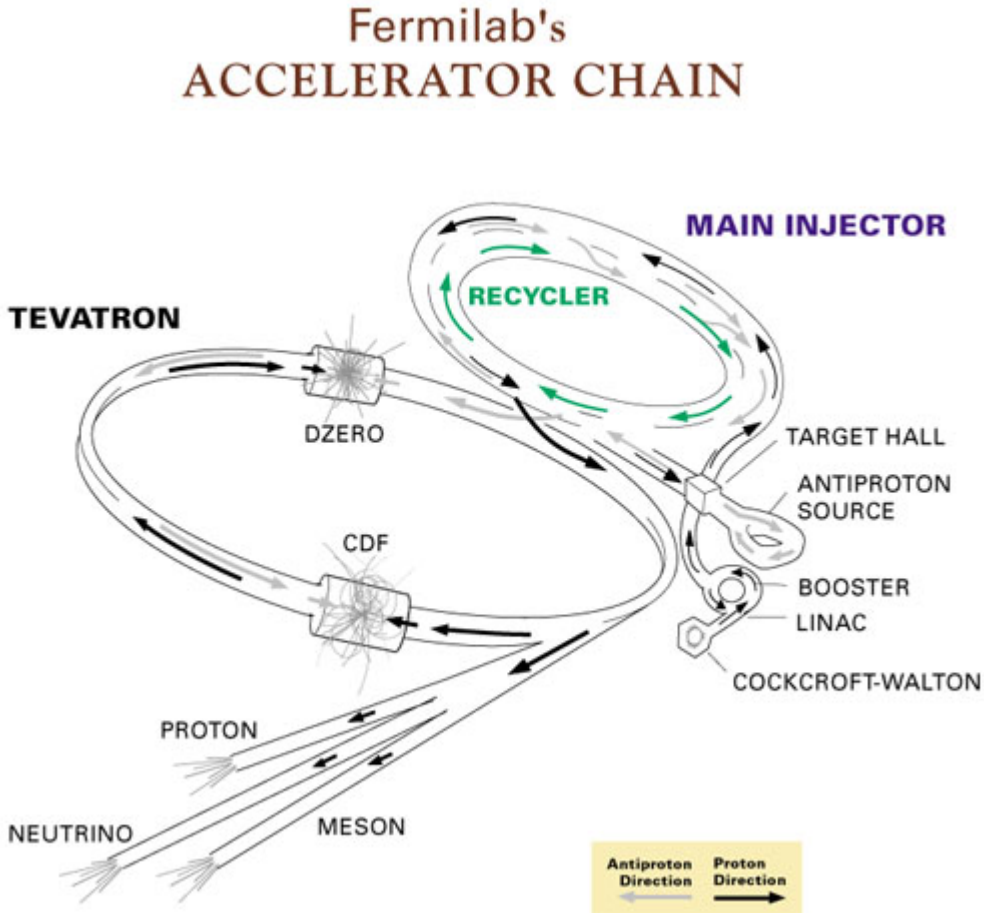
Accelerator Program Mission



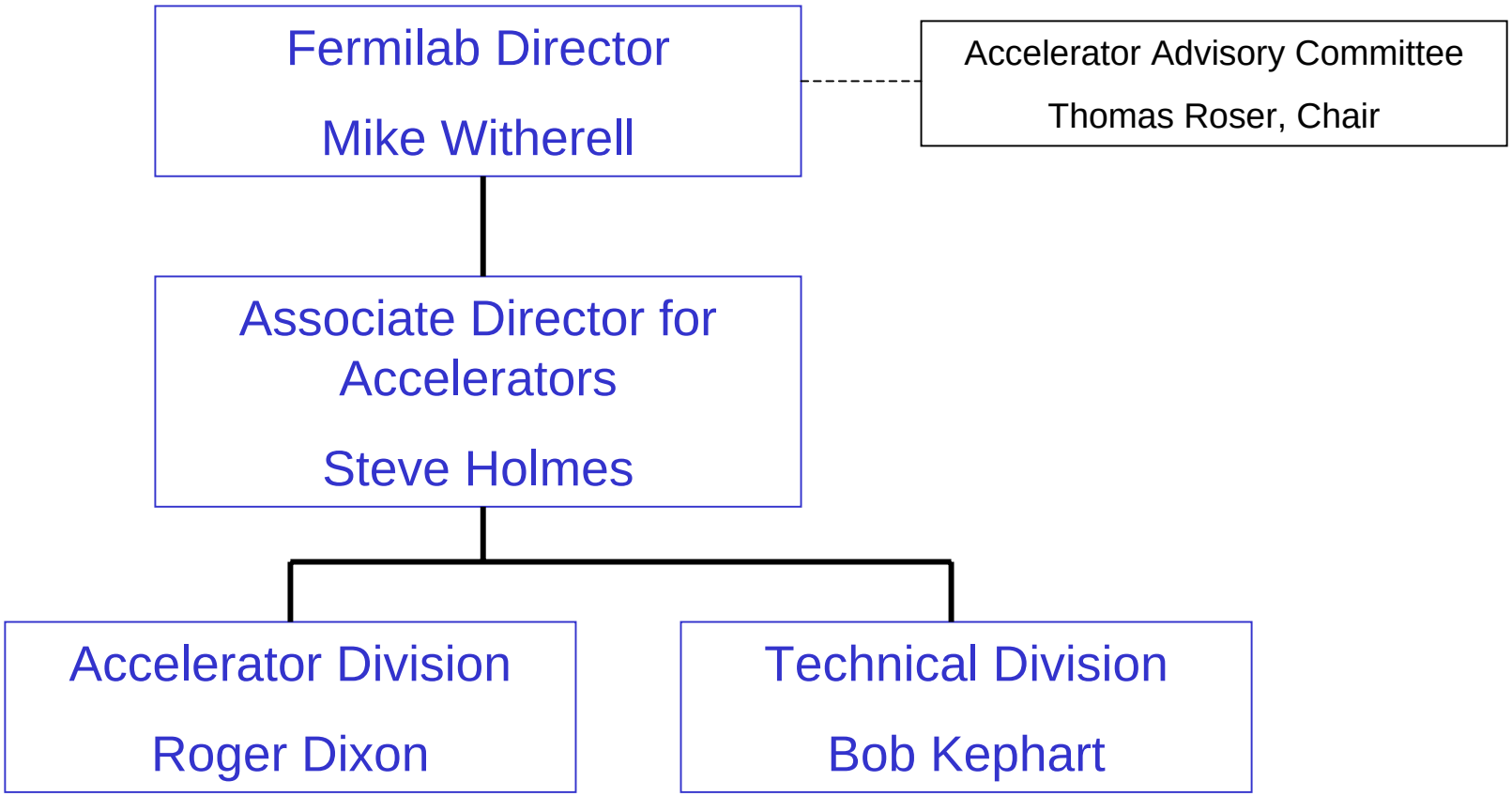
- Operations Review:
  - Maintenance and operation of the accelerator complex in support of the HEP research program.
  - Improvement of accelerator performance to meet evolving goals.
- Program Review
  - R&D in accelerator technologies aimed at next generation HEP facilities and beyond.
  - Construction of new accelerator facilities.

Accelerator Program Mission

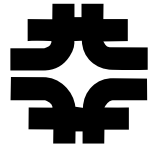
- 7 miles of accelerators
- 8 accelerators/storage rings
- 5 miles of beamlines
  (not counting 500 mile "ν beamline" to Soudan)
- 4 programs supported simultaneously
- 700 people
- 41 weeks of operation a year (nominal)



Accelerator Line Organization



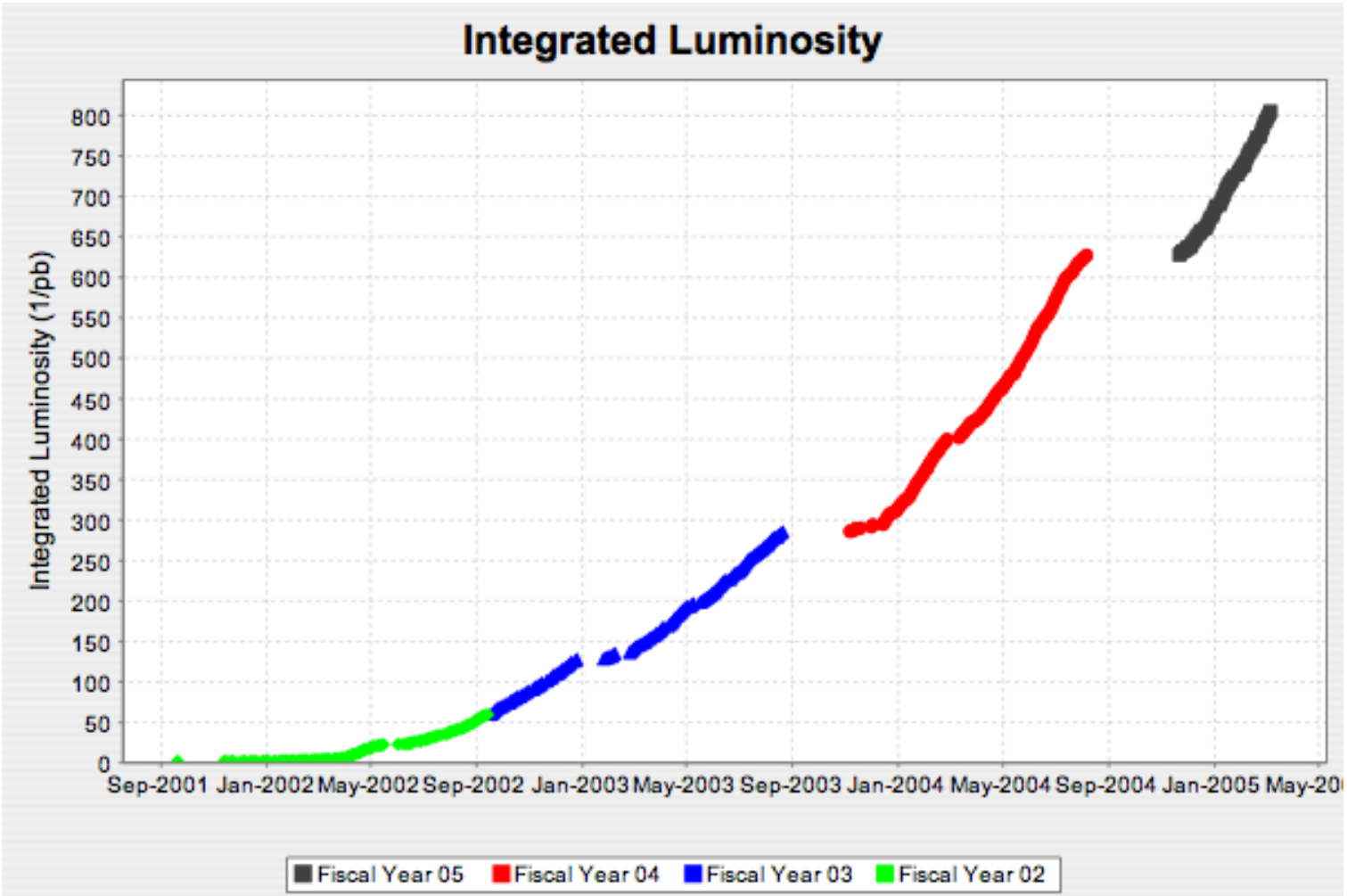
Accelerator Operations: Scope



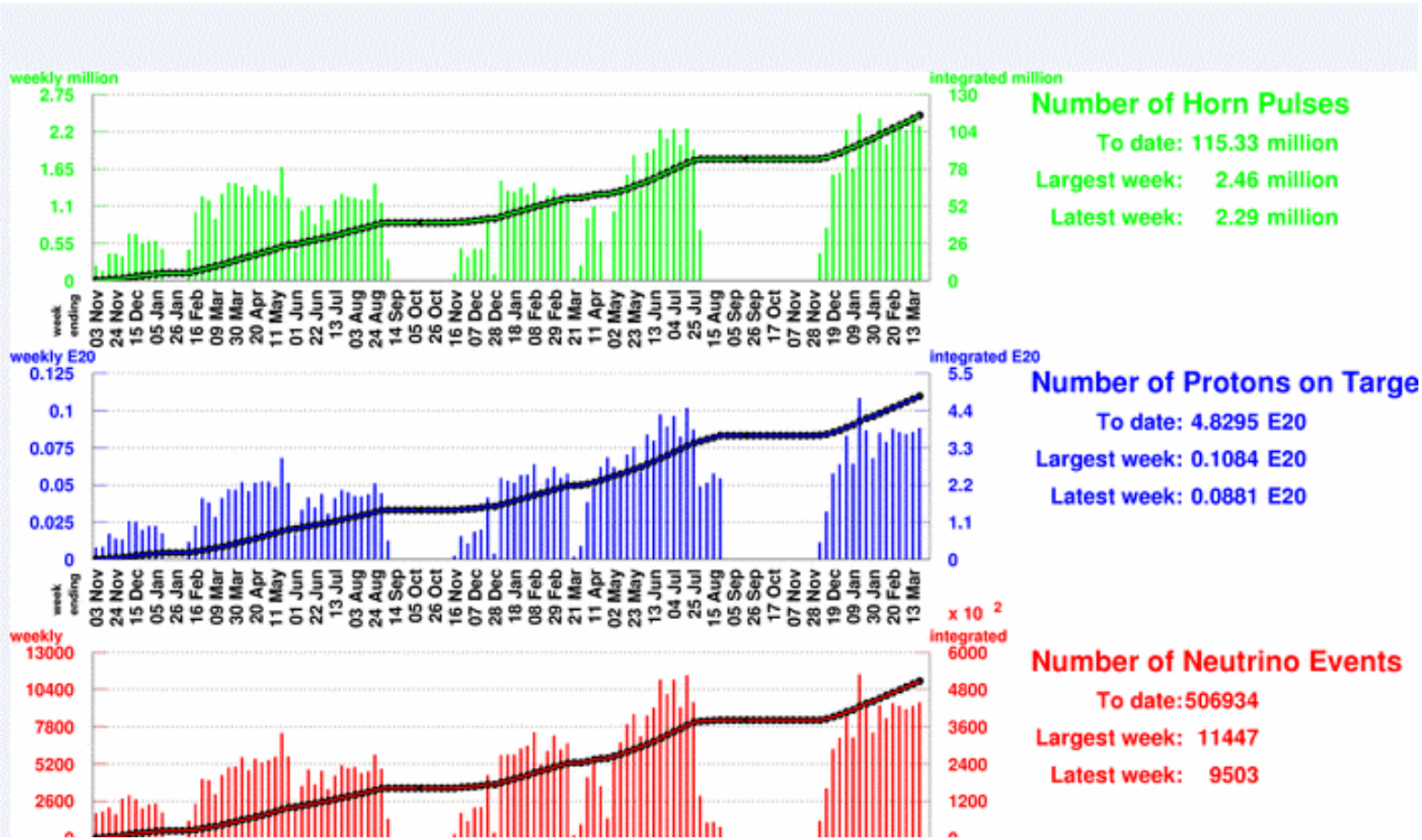
- Collider Run II
- MiniBoone beam
- NuMI beam
- 120 GeV slow extracted beam

} Operations, maintenance, and upgrades

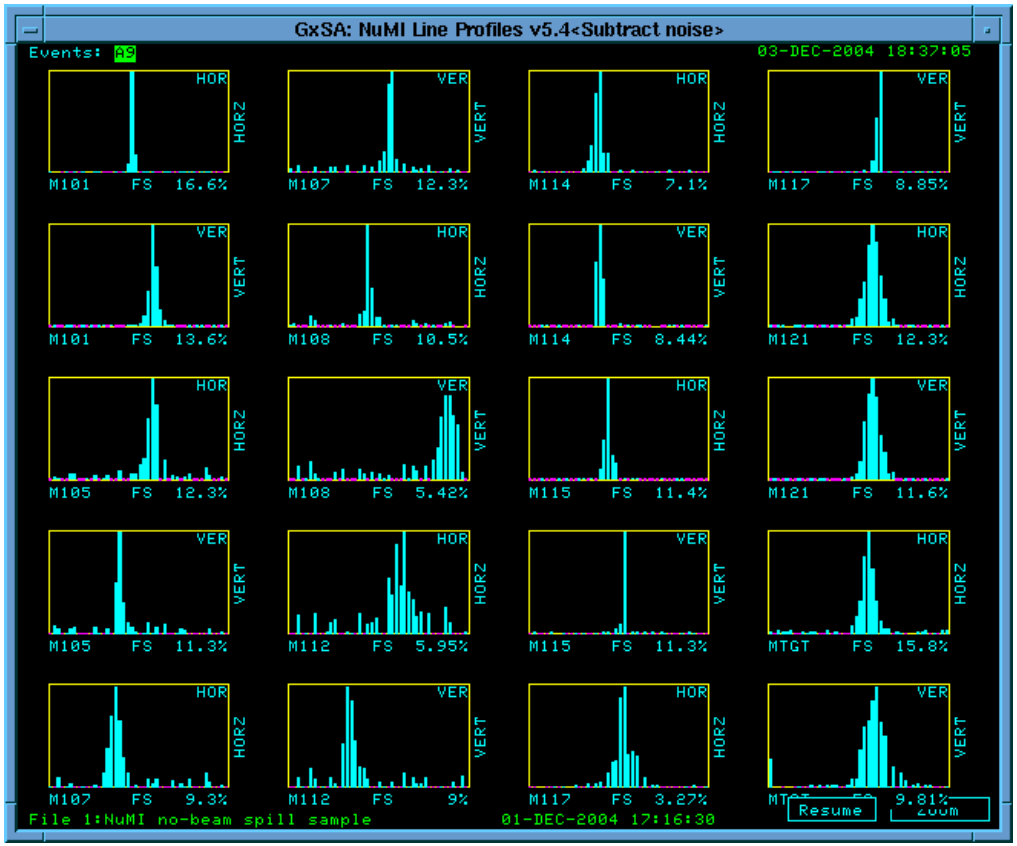
Run II Operations



MiniBoone Operations

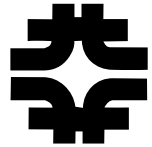


NuMI Operations



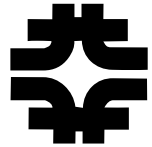
December 3, 2004: First NuMI beam

Accelerator Operations Goals



- Strategic Context
  - Run CDF and D0 through FY2009
  - Run MINOS (and perhaps MiniBoone or successors) at least through end of decade.
  - Operate 120 GeV fixed target program in parallel
  - Set stage for the future (neutrinos and ILC)
- FY05-09 Goals
  - Run II: Complete Run II Upgrade Program; deliver 8 fb^{-1} (design curve, total)
  - Neutrino Program: Complete the Proton Plan
    - NuMI: Deliver 2-3E20 protons on target/year
    - 8 GeV: Deliver 1-2E20 protons on target/year
  - SY120: Operate in parallel with Run II and ν

Strategy w/ Flat FY2006-09 Budgets



- Support of Run II Upgrade (FY2007 completion) and operations
  - Constant level of effort for accelerator operations over FY2005-2007.
  - < constant level of effort for Tevatron and Antiproton Source operations in FY2008-09.
- Support for Proton Plan upgrades (FY2008 completion)
  - With possible staged transition to Proton Driver
- Redirect resources coming off of Run II Upgrades and BTeV, onto Proton Plan, Linear Collider, Proton Driver, and LARP.

Accelerator Ops: Resources

	Accelerator Operations Budget					
	(Dollar amounts in thousands, direct costs only)					
	FY04	**FY05**	**FY06 PBR**	**FY07**	**FY08**	**FY09**
Accelerator M&O	$47,124	$47,635	$51,876	$52,377	$52,000	$52,255
Accelerator Upgrades - R2LU	$20,964	$15,620	$3,937	$1,353	$0	$0
Accelerator Upgrades - Other	$4,081	$2,836	$4,033	$3,863	$3,960	$4,086
Proton Plan	$0	$7,327	$7,846	$6,915	$6,116	$0
Experimental Initiatives and External Beam	$3,226	$4,121	$4,090	$4,271	$4,445	$4,651
NuMI/MINOS	$3,537	$4,446	$2,911	$2,947	$3,067	$3,209
Other Direct Support	$18,147	$17,671	$17,623	$17,891	$17,891	$17,891
LHC Support (KA 11 01)	$141	$230	$122	$127	$132	$139
Operations Total, SWF + M&S	**$97,221**	**$99,886**	**$92,438**	**$89,745**	**$87,612**	**$82,231**
Subtotal SWF	$67,931	$69,932	$67,125	$65,865	$64,142	$64,327
Subtotal M&S	$29,290	$29,953	$25,313	$23,880	$23,471	$17,904
Future Accelerator R&D (Program Review)	**$9,967**	**$17,334**	**$22,335**	**$23,347**	**$23,511**	**$25,730**

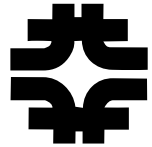
Note: ~30% reduction in total real resources, 22% in FTEs, over FY2005-09.

Power and Infrastructure

- Power bill based on average 41 weeks operations/year over FY2005-09.
- GPP
  - Utilities infrastructure, computing facilities, etc.
- UIP
  - Program discontinued, but payments live on…

	Power and Infrastructure Budget					
	(Dollar amounts in thousands, direct costs only)					
	FY04	**FY05**	**FY06 PB**	**FY07**	**FY08**	**FY09**
Power & Utilities	$15,397	$16,650	$18,315	$18,315	$20,030	$20,537
GPP & UIP	$10,962	$13,000	$12,185	$12,185	$12,185	$12,185
Indirect Support	$2,106	$500	$500	$500	$500	$500
Power & Infrastructure Total, SWF + M&	**$28,465**	**$30,150**	**$31,000**	**$31,000**	**$32,715**	**$33,222**

Challenges and Risks



The Tevatron complex is being counted on to support operations at the highest performance levels in history, through at least 2009.

- Risk elements
  - Managing the run up to shutdown of the Tevatron
    - Reliability of Tevatron and Antiproton Source as real maintenance budgets are decreased
    - Reducing staff assigned to operations without creating an exit stampede

    $\Rightarrow$Mitigation: Accept reliability risk; reassign staff to future R&D.

Challenges and Risks

- Risk elements (cont)
  - Reliability of aging accelerators
    - Linac and Booster are the most serious

    ⇒Mitigation: Proton plan; Run II Upgrade; spares inventory buildup
  - Technical challenges in remaining Run II Upgrades
    - Electron cooling
    - Stack-tail upgrade

    ⇒Mitigation: R&D and decision points within the Run II Plan

Challenges and Risks

- Risk elements (cont)
  - Proton demand for Run II+NuMI+Booster Neutrino
    - Requires doubling the current throughput of the Linac and Booster
    - Desirability to operate the Booster Neutrino Program in parallel with NuMI

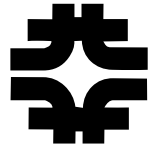
    $\Rightarrow$Mitigation: Proton Plan

Challenges and Risks

- Long Term Risks
  - The primary risk in the long term is the loss of our technical capabilities as we approach the Tevatron shutdown, jeopardizing the long term future of Fermilab as the flagship laboratory for accelerator based U.S. HEP beyond 2010.

  ⇒Mitigation: Establish a bridge project toward the future.

Up 4% & Recommendations



- 4% up scenario (FY2008-2009)
  - Accelerator M&O unchanged
  - Accommodate modest scope addition to Proton Plan
  - Priority to future accelerator R&D program
- Recommendations from prior reviews.
  - All recommendations from February 2004 Run II and March 2004 Operations Reviews have been considered. Response “scorecards” are in your notebooks.

Summary

- Run II, MiniBoone, and Switchyard 120 are running well; NuMI is off to a good start.
- Run II and Proton Plan Upgrades are supported within a flat FY2006-09 budget.
- Staff reductions are required to provide an effective balance of SWF and M&S.
- We are accepting reliability risks in the Tevatron program in FY2008-09 as emphasis switches to neutrinos and ILC.
- The long term issue is how to retain our capability to implement a future.